931710

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Gaskets

We, THE CORRUGATED PACKING & SHEET METAL COMPANY LIMITED, of Wolsley Street, Gateshead, 8, in the County of Durham, England, a British Company, and TERENCE PETER NICHOLSON, of "Craigmillar", Stocksfield, in the County of Northumberland, England, a British subject, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed to be described in and by the following statement:—

This invention is for improvements in or relating to corrugated gaskets. The invention is more particularly applicable to gaskets such as are used, for example, to obtain a fluid-tight joint between the cylinder head or crank case and the cylinder block of an internal combustion engine. This application is, however, only mentioned by way of example because corruguated gaskets can be used in a large variety of circumstances where a fluid-tight joint is required between two faces or elements.

One known form of corrugated gasket comprises a relatively thin sheet of metal cut to the shape of the two faces to be mated together and appropriately apertured to register with the apertures in said faces through which the fluid, generally under pressure, flows. After the sheet metal has been cut to shape one or more corrugations are embossed around said aperture or apertures. When such a gasket is fitted into position between the two mating faces and the latter are bolted or otherwise secured together a very satisfactory fluid-tight joint may be obtained.

There is practically no limit to the number of apertures which can be provided in a single gasket and by changing the width, pitch, height and number of corrugations, in proportion to the thickness and hardness of the material used, satisfactory fluid-tight joints can be obtained in the most difficult circumstances. However, there are circumstances, having regard to the exceedingly high and low temperatures and pressure obtaining at the present time, where corrugated gaskets as available heretofore have not been entirely satisfactory and one object of the present invention is to provide a corrugated gasket which will satisfy these very exacting requirements. According to the present invention there is provided a corrugated gasket comprising a sheet of metal having a high degree of resistance to compression and a high degree of resilience, as compared with mild steel, and a sheet or facing element of a substantially softer material said sheets or sheet and facing element being bonded together by soldering, brazing or by the use of an adhesive.

The expressions "high degree of resistance to compression" and "high degree of resiliency" as used herein, in relation to one of the sheets forming the body of the gasket, are intended to distinguish the gasket according to the present invention from previously proposed corrugated gaskets comprising a sheet of metal such as mild steel coated with a softer metal. A sheet of mild steel would not be suitable for the purpose of the present invention because mild steel does not possess the necessary degree of resistance to compression and high resilience. The metal used for the gasket according to the present invention and having a high degree of resistance to compression and a high degree of resiliency should generally be one in at leat the upper and of the half hard range, stainless steel being one such material which is particularly satisfactory for the purpose of the invention.

The reason why it is important for the purpose of the present invention to select a metal having a high degree of resistance to compression and a high degree of resilience is that such gaskets are designed for use primarily in the exacting conditions to be found in modern engine design, and particularly aircraft engine design, where the gasket is required to take up any distortion of the faces between which it is fitted and at the same time must withstand the heavy degree of vibration to which it will be subjected.

Conveniently the said sheet of metal is of stainless steel or other ferrous metal whilst the

other sheet is of a material having a high degree of ductility and ability to flow and fill the grain structure on the mating faces to be jointed together in a fluid-tight manner. Such a material is, for example, a nickel alloy, copper, aluminium or the like.

Metals such as nickel alloys, copper, aluminium and the like are excellent sealing mediums because of the ductility and ability to flow and fill the grain structure on the mating faces. Unfortunately these metals have the disadvantage of being too easily compressed and therefore the high unit loading is lost. Furthermore these metals have very little if any recovery value or spring effect which is an important requirement where the joint is to be subjected to pulsations due, for example, to pumping or other forms of vibration.

Materials such as stainless steels and other ferrous metals, in the quarter-hard, half-hard or hard range have a greater resistance to compression and a high recovery value or spring effect under sustained pulsations. However in a gasket such metals have the short-coming that they lack ductility and have to be used in conjunction with joining compounds of varnishes and even so do not always result in a satisfactory joint.

It will be appreciated that the present invention makes use of the combined advantages of ductility and ability to flow of the softer metals such as nickel-alloys, copper, aluminium or the like and the resistance to compression and high recovery value or spring effect of the harder metals such as stainless steels and other ferrous metals. These advantageous properties are all combined into one complete unit or gasket.

Conveniently in carrying the invention into effect, according to one embodiment of the invention, a sheet or strip of hard and resilient metal has bonded to both its sealing faces a sheet of material which is softer and more ductile than said hard and resilient sheet. Thus, the complete gasket will have a hard resilient core to provide crush resistance and spring effect and a softer material on each face which will flow and fill the grain structure of the mating faces of the joint and thus afford an excellent sealing medium.

The two or three layers of material can be bonded together first, to form a laminated sheet, and then apertured and embossed with the necessary corrugation or corrugations or the layers can be apertured and embossed separately and subsequently bonded together.

The actual materials forming the layers of the gasket (e.g. their relative hardness and ductability) and the size, shape, height and number of corrugations is selected according to the type of joint to which the gasket is to be applied taking into consideration such circumstances as surface finish, stable or unstable faces and whether this is due to lack of support, pulsation, uneven bolt stresses stresses through change of temperature and pressure and other important factors which vary with different applications.

In some circumstances more than one corrugation will be required around each aperture and these may or may not be embossed so that there are peaks of corrugations on both faces of the gasket. Furthermore corrugations may need to be added not for sealing purposes only but to prevent distortions of the mating faces due to a cantilever effect or the like.

If there are weak spots in the mating faces of the joint to be sealed or there are insufficient bolts it may be necessary, particularly in the case of multi-aperture applications, to have corrugations of different shape or height. For instance, the strongest corrugation will generally be around the high pressure ports or apertures and a softer or lower corrugation around the lower or unpressurized ports or apertures.

The gasket may be electro-plated or coated with lacquer or otherwise treated so as to afford protection, particularly at the exposed edges, if the gasket is to be subjected to corrosive conditions.

The thickness of the softer face or facings of the gasket will generally be adjusted to suit the machine finish of the mating faces of the joint, a thicker facing usually being required for a coarse finish and a thinner facing for a fine finish.

The hard, resilient sheet of the gasket need not, necessarily, be thicker than the softer sheet. It may have the same thickness or be even thinner if desired.

If the gasket has a facing sheet or element on both sides that on one side may be different material or have different properties to that on the other side.

A gasket according to the present invention can be made of a variety of different metals or materials, provided they have the characteristics previously set forth, and the shapes and sizes of the corrugations may vary considerably as between one gasket and another. For instance the corrugations may be of V, square, arcuate or other cross section and their peaks may stand proud of one side or both sides of the plane of the gasket.

Instead of covering one or both faces of the hard resilient sheet of the gasket wholly with a sheet, of softer material, or in addition to doing this, the aperture or apertures may be "eyeletted" locally. The eyeletting may be done with a material which, in addition to being relatively soft, is designed to protect the gasket against the action of corrosive chemicals and where the gasket is dealing with joints in pipes or the like through which different fluids flow then the eyeletting may be effected in different materials or metals according to the corrosive action it is required to resist. Such would, for example, be the case where the gasket has to withstand excessively high

temperatures and the corrosion effect of burnt gases.

The gasket if desired, may be lacquered, electro-plated, dyed or otherwise treated to withstand varying conditions and give added sales attraction.

Some embodiments of the invention will now be described, by way of example, with reference to the accompanying drawing whereon:—

Figure 1 is a fragmentary plan view of a typical corrugated gasket for use between the cylinder and cylinder head of an internal combustion engine.

Figure 2 is a cross section on the line II—II of Figure 1 to an enlarged scale,

Figure 3 is a cross section, to an enlarged scale, on either of the lines III—III of Figure 1.

Figure 4 is a plan view of a further form of corrugated gasket,

Figure 5 is a sectional view on the line V—V of Figure 4,

Figure 6 is a plan view of a still further form of corrugated gasket,

Figure 7 is a sectional view to an enlarged scale on the line VII—VII of Figure 6,

Figure 8—12 inclusive are fragmentary sectional views showing the more common forms of corrugation utilised in corrugated gaskets, and

Figures 13 and 14 are fragmentary cross-sections of laminated gaskets.

In the embodiment of the invention shown in Figures 1, 2 and 3 the gasket has a core 10 in the form of a relatively hard and resilient sheet of metal (e.g. stainless steel) to which are bonded, by brazing, soldering, or by an adhesive, sheets or foils 11 and 12 of a softer and/or more ductile metal. The gasket, after the manner of corrugated gaskets, is provided around the openings or apertures in it with corrugations 13, 13*a*, and 13*b*.

As an example the core 10 may be of stainless steel having a thickness of 0.015 inches and the top and bottom facings 11 and 12 may be of aluminium foil having a thickness of 0.002 inches approximately. Also by way of example, the corrugations 13 (high pressure gas) may have a height of 0.020 inches with a width of 0.080 inches, the corrugations 13*a* (oil drain) may have a height of 0.010 inches and a width of 0.080 inches and the corrugations 13*b* (high pressure oil and medium pressure water) a height of 0.015 inches and a width of 0.080 inches approximately.

In the embodiment of the invention shown in Figures 4 and 5 the body 14 of the gasket is of thin sheet steel or other metal of a relatively hard nature as defined above which, after being corrugated at 15, has bonded on its upper face, by brazing, soldering or an adhesive, a sheet of aluminium of, for example, 0.002 inches or thereabouts in thickness.

In the embodiment of the invention shown in Figures 6 and 7 the corrugated gasket has apertures which are "eyeletted", both above and below, with a soft aluminium eyelet or facing element 16. These eyelets are brazed, soldered or stuck to the apertured body of the gasket in the flat and subsequently embossed to give the corrugated form and the eyelets may be of a composite nature e.g. to provide a soft surfaced corrugation on the upper side of the gasket and a hard surface corrugation on the under side.

Figures 8 and 12 are self explanatory and as stated previously show various alternative forms of corrugation which may be used in corrugated gaskets according to the present invention.

Figure 13 shows a gasket comprising a laminated core 17, of sheets of a hard metal, having bonded to it on both faces, as described, a metal 18 of a softer nature.

Figure 14 shows an arrangement similar to Figure 13 but in which only one face of the laminated body 17 of the gasket is provided with a surface layer.

In some cases the surface sheet or facing may be laminated.

The two or more layers forming a laminated corrugated gasket, or part thereof, according to the present invention may be of the same material but differing in that one is harder or less ductile than the other.

It should be understood that the facing layer or sheet may be any suitable metal or material provided it is relatively soft as above described and is not necessarily of cupro-nickel, copper or aluminium.

The facing on one side of the gasket may be carried through the aperture or apertures to cover the opposite side to the outer diameters at least of the corrugation or corrugations surrounding that aperture of apertures.

It should be understood that the invention comprises within its scope any practical size and shape of corrugation.

WHAT WE CLAIM IS:—

1. A corrugated gasket comprising a sheet of metal having a high degree of resistance to compression and a high degree of resilience, as compared with mild steel, and a sheet or facing element of a substantially softer material, said sheets or sheet and facing element being bonded together by soldering, brazing or by the use of an adhesive.

2. A gasket as claimed in claim 1 in which the sheet of metal has bonded on both faces a sheet of softer material.

3. A corrugated gasket as claimed in any of the preceding claims wherein the sheet of softer material is nickel-alloy, copper or aluminium.

4. A corrugated gasket as claimed in any of the preceding claims wherein the sheet of metal of high resistance to compression and high resilience is of stainless steel.

5. A corrugated gasket as claimed in any of the preceding claims and apertured and faced

locally or "eyeletted" around the aperture or apertures with the facing sheet or element of softer material.

6. A corrugated gasket as claimed in any of the preceding claims and having a plurality of apertures and at least one corrugation around each aperture, wherein said corrugations vary in height as between the corrugation around one aperture and the corrugation or corrugations around another or others.

7. A gasket as claimed in any of the preceding claims, wherein the corrugation or corrugations is or are of triangular cross-section.

8. A gasket substantially as herein described.

9. A gasket substantially as herein described with reference to Figures 1, 2 and 3; Figures 4 and 5; Figures 6 and 7; and Figures 8 to Figure 12 inclusive, or Figures 13 or 14 of the accompanying drawings.

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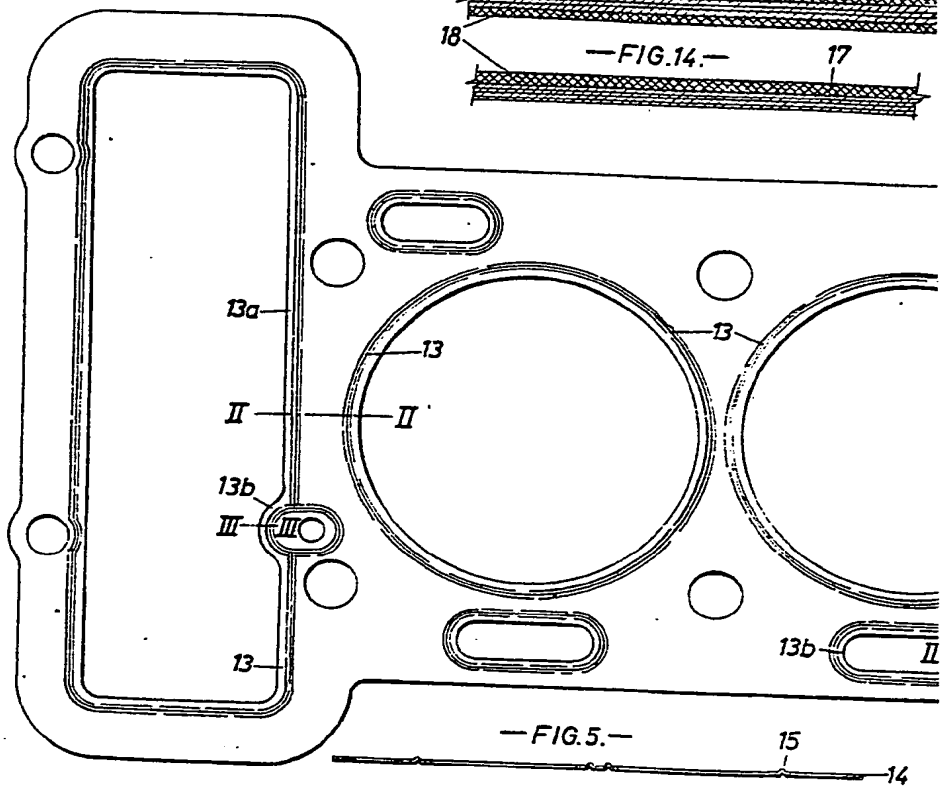
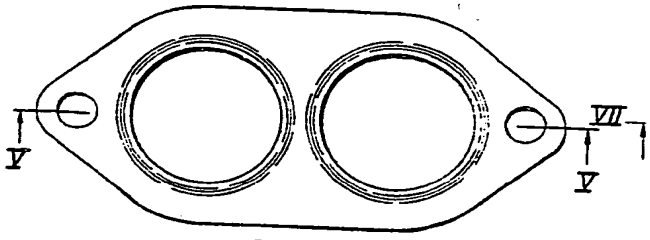
— FIG. 1. —



— FIG. 13. —

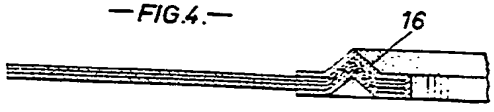
— FIG. 14. —

— FIG. 5. —



— FIG. 4. —

— FIG. 7. —



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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

FIG.13.—

FIG.14.—

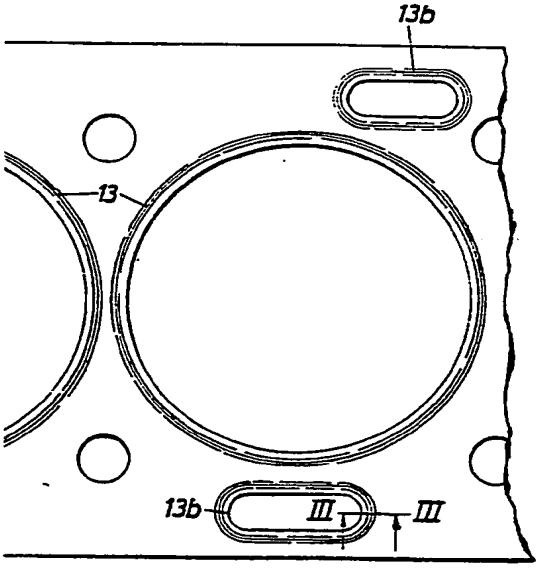
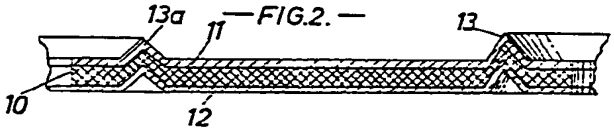


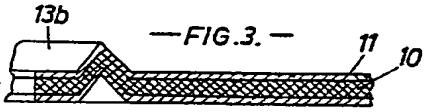
FIG.2.—



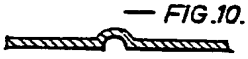
— FIG 8.—

—FIG.9.—

FIG.3.—



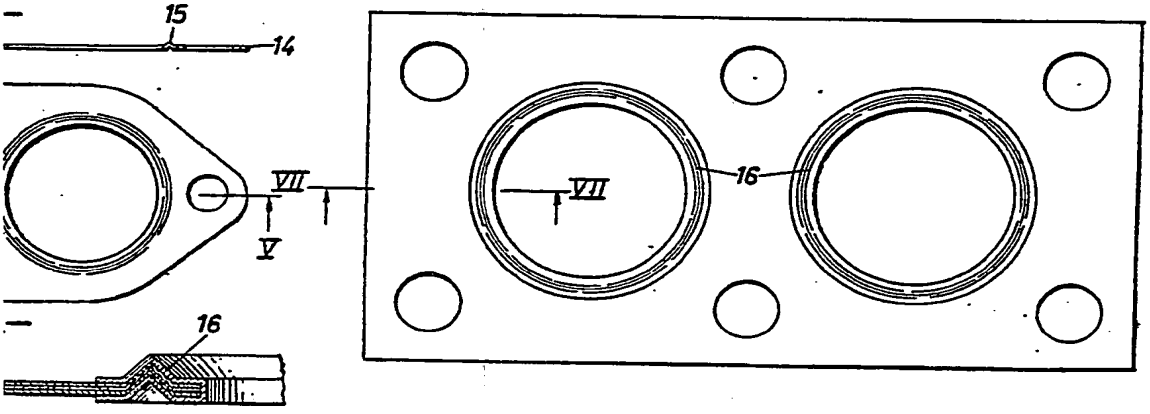
— FIG.10.—



—FIG.11—

—FIG.12.—

— FIG.6.—



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